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Biodiesel and glycerol transesterification by layered double hydroxides in stirring packed-bed reactorJeffrey C S Wu and Yu-Ting Hsu
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In this research, we transesterified (1) triglycerides to synthesize biodiesel and; (2) its byproduct glycerol to form a more valuable chemical, glycerol 1,2-carbonate, using layered double hydroxides (LDHs), specifically Mg-Al LDH. We studied the different Mg/Al ratios in catalyst preparation, calcination temperatures of LDH, reaction temperatures, catalyst loadings and the molar ratios of dimethyl carbonate/glycerol, etc., which are critical factors in both transesterification reactions. We had Mg-Al LDH coated on the 3mm spherical α - Al_2O_3 catalyst in the stirring packed-bed reactor. Mg-Al LDH was first calcined and then rehydrated with decarbonated water-glycerol solution to reconstruct the layer structure and also to protect the catalyst deactivation by air at the same time. In biodiesel synthesis, the yield reached 65.72% in 4 hours under 60°C, 87.45% in 3 hours under 100°C, when the methanol/soybean oil molar ratio was set to be 30, and 10wt% Mg/Al=5 LDH was used in the reaction. The glycerol transesterification was carried out by dimethyl carbonate/glycerol molar ratio 16 with the existence of solvent, dimethyl sulfoxide, using 10wt% Mg/Al=5 LDH on spherical α - Al_2O_3 at 95°C. The yield of glycerol 1,2-carbonate could reach up to 93.4% within 7.5 hours. When applying 10wt% catalyst of Mg/Al=5 LDH on spherical α - Al_2O_3 into the stirring packed-bed reactor, the yield of glycerol 1,2-carbonate reached to 80.17% within 11 hours under the residence time 22.5 hours, and dimethyl carbonate/glycerol molar ratio = 16 at 90°C.

Biography

Jeffrey C S Wu received his PhD in Chemical Engineering from the University of Pittsburgh, USA. Currently, he is serving as Associate Chair of the Chemical Engineering department, National Taiwan University. He is a member of the Taiwan Institute of Chemical Engineers. He is author and coauthor of over 100 SCI journal papers, one book chapter and two textbooks of chemical industry and catalysis. He is the Editor of *Catalysis Communications*, and serves in editorial boards of *Applied Catalysis A: General* and *Chemical Engineering Journal*. He received many prestigious awards including Outstanding Cross-Sector Collaboration Award and 2nd National Industrial Innovation in 2012.

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